TRUSS-BRIDGES.

AN ILLUSTRATED HISTORICAL DESCRIPTION OF ALL EXPIRED PATENTS ON TRUSS-BRIDGES, WHICH UNDER THE LAW ARE NOW PUBLIC PROPERTY AND FREE TO BE USED BY ANY ONE.

By F. B. Brock, Patent Attorney, Washington, D. C.

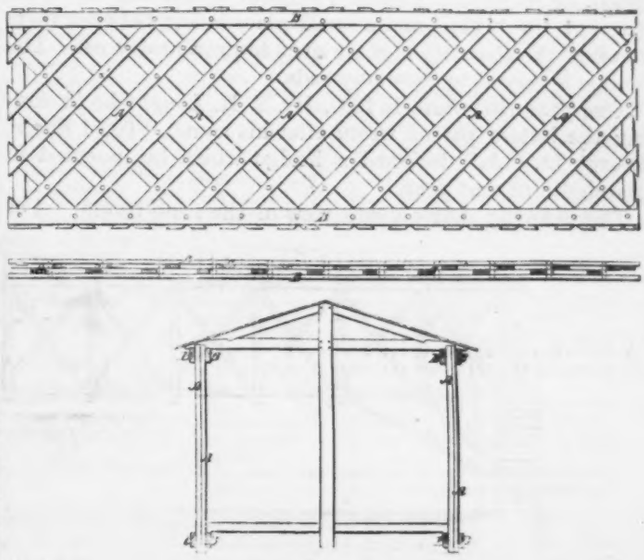
The following series of articles comprise an illustrated historical and chronological sketch of all the patents issued by the United States Patent Office, under the above head, which have expired and are now public property. As such, the ideas embodied herein are free to be used by any one so disposed. It is not contended that all of these inventions are useful and worthy of adoption, for the progress of bridge building since the conception of these devices, like the progress made in science and all the kindred arts, has rendered some of them obsolete and of interest only as a matter of history. It is the endeavor to make this class of invention complete so far as patented devices are concerned, the period of whose protection has elapsed. The government granted them a monopoly of their inventions for a certain number of years, in return for which they agreed, as a part of the contract, to give their inventions to the world. Many of them are valuable and have come into general use, and will be recognized by the reader as forming a part of the bridge construction of to-day; while others, and perhaps equally meritorious, will appear for the first time in print, having never existed except upon paper and perhaps an experimental model or so. This is generally due* to the absence of such business qualities in the inventor as will bring the invention before the public so as to secure its adoption.

To bridge builders these articles, apart from their interest as a historical sketch, will have a special value, for they can readily ascertain what devices in bridge construction they can use without infringement of any patent right. They have a further value in that, should they receive notice from patentees to the effect that they are infringing any patented bridge, they can consult these papers in order to ascertain, so far as American expired patents are concerned, whether such is the case.

BURR'S TRUSS BRIDGE.

The first patent* ever granted by the United States Patent Office for a truss bridge, was issued to Theodore Burr, April 3, 1817. The drawing shows its general form. The lower chord of the bridge was laid upon the abutments or piers and supported the roadway. The following quotation shows how considerate and explicit an inventor was in those days in the details of construction: "The crown plates require to be raised above the floor sufficiently high to admit wagons or carriages, with any common load, to pass under the beams that lie crosswise and on top of the crown plates." Both the lower and upper chord, or crown plate, may be of two pieces, with king-posts embraced between them; or they may be single and put together by mortises. The diagonal braces are angled, as shown in the drawing, to obviate mortising. The inventor also designed placing a foot-walk outside the main bridge, and projecting for that purpose, the cross-beams of the roadway to support it. The arch sprang from the abutment from below or on the lower chord line to about the height of the bridge, and was either single or double. The inventor claimed such an arch made double or single; also the angled diagonal braces, without tenon or mortise, and the foot-way outside the bridge.

There is no doubt that this patent, in parts at least, was erroneously granted, for its general features were in existence in bridge building before that date. Moreover, the inventor, in 1837, filed a disclaimer, disclaiming the inclined planes on the abutments, the angled diagonal braces secured without tenon or mortise, and the foot-way arranged outside the bridge. This disclaimer is of interest as being the first ever entered by any patentee in the history of the Patent Office.



TOWN'S BRIDGE.

January 28, 1820, the Patent Office issued letters patent to one Ithiel Town. Fig 1 represents a side elevation of a section of the truss, and fig. 2 a top sectional view of the same. Fig. 3 is an end view. This drawing was destroyed by the fire of 1836, the original of the present drawing being made by the Patent Office from the specification of the patent. One series of the slat pieces *A A* are arranged parallel at an angle of forty-five degrees to a horizontal line; the other series crossing the first at right angles and having the same degree of inclination, forming an open lattice work. The longer the slats are in proportion to the distance between them, the smaller will be the area of the open work, and the more times each piece in one series will be crossed by those of the other series, consequently the greater number of joints, and therefore the more strength and less strain upon each joint when weight is applied to the bridge.

The timbers or chords *B B* take up the thrust strain. No lateral pressure is exerted against the piers or abutments. This bridge is designed to be covered, as shown in fig. 3.

In 1829 (Dec. 22), Lewis Wernwag got up an elaborate design for a bridge, shown by the accompanying drawings, which represent two modifications of bridge architecture. These bridges consist chiefly in having king-posts eight to twelve feet apart, and which are connected at equal distances by horizontal string pieces and stretchers by joining them by laps. The whole superstructure is made without mortise or

Copyright, 1882.

* This patent of Burr's was in fact preceded by other bridge patents, which were unfortunately destroyed by the fire of 1836. It was attempted to restore these patents, but all efforts were unavailing, the authorities being unable to then obtain the address of the patentees. The following record of them is all that remains:

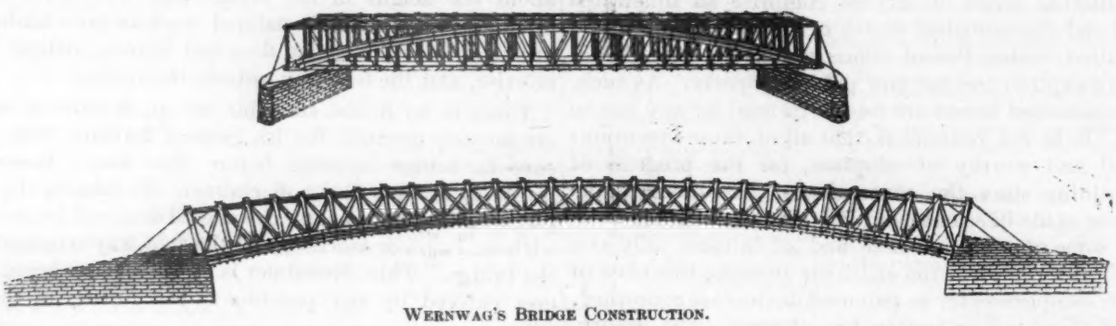
Charles W. Peale, Jan. 2, 1797, Penna.	James Finley, June 17, 1808, Penna.
Charles Fowler, Feb. 24, 1797, Penna.	John Templeman, March 6, 1810, Md.
John Stickney, June 3, 1797, Mass.	Joseph J. Deyster, Feb. 23, 1810, Penna.
Timothy Palmer, Dec. 17, 1797, Mass.	Joseph Jessup, July 1, 1881, Penna.
Theodore Burr, Feb. 14, 1806, Mass.	Lewis Wernwag, March 28, 1812, Penna.
Thomas Pope, April, 18,1807, N. Y.	Benjamin Connor, April, 23, 1812, N. H.
John Templeman, Aug. 16, 1808, Md.	George Tabb, Feb. 23, 1816, Va.

After the grant of Theodore Burr's patent of 1817 the following patents were granted, which were destroyed in the great fire and were never restored:

Naptali Bishop, Jan. 11, 1819, Vt.	George W. Long, March 10, 1830, La.
John Bragg, Jan. 4, 1820, Canada.	George Law, June 12, 1835, Pa.
William Woodmansee, Mch. 6, 1827, Vt.	R. I. L. Whitley, Oct. 14, 1835, Mass.

With reference to these patents, however, it is not known whether they were for truss bridges, or bridges of other description.

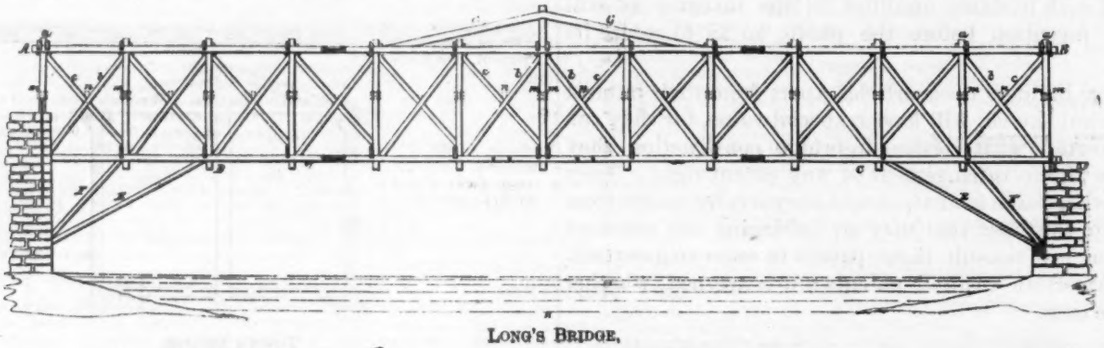
tenon. All the pressure is exerted endwise. The whole bridge is put together by screw-bolts in such manner that the bridge can be stiffened should any of the timbers shrink. The design of truss shown by the first illustration comprises one arch on each side of the bridge and one or more arches in the centre. These arches are made of segments of two or more splices or plies. The splices can be augmented, diminished, or changed at pleasure, without disturbing the other parts of the bridge, and a small place is left between them to allow the circulation of air so as to prevent dry rot. The bridge is braced by iron stay-rods.



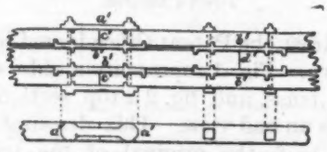
WERNWAG'S BRIDGE CONSTRUCTION.

One year afterward, in 1830, Mr. S. H. Long, who in signing the letters patent wrote after his name, "Top'l Eng'r, Brevet Lt. Col.," designed a bridge which he patented in March 6th of that year.

The drawing shows a side view of the truss frame. *A B* is the upper chord, and *C D* the lower, *a a* are the posts or uprights, *G G* are the superior arch braces, *E F* secondary braces under the second and third posts from either end of the truss, *b b* are the main diagonal braces, and *c c* the counter braces, *m m* are the clamp beams, and *n n* the floor timbers. The string pieces or chords are spliced by either wooden or iron splicing pieces.



LONG'S BRIDGE.

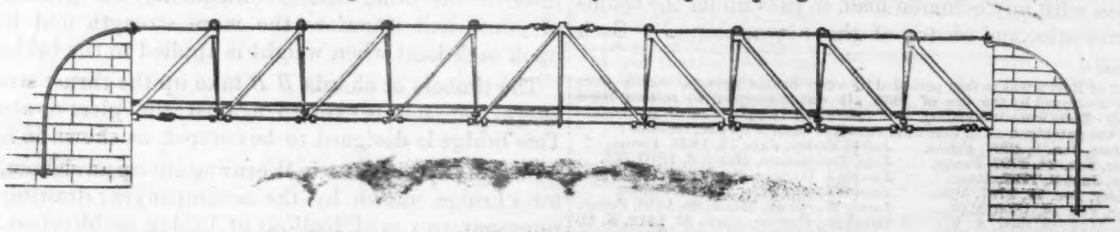


DETAILS OF SPLICED CORD.

The system of bracing employed exempts, so the inventor says, the truss frames from leverage in parts liable to be effected by such action. A system of counter bracing is also employed which renders the truss frame unyielding and stiff when the bridge is loaded or unloaded. The main braces and posts are designed to be furnished with metallic bearings, by the introduction of thin plates of iron or copper between the heel and toe of each main brace and the steps in the post against which they thrust. A mode of keying or wedging is employed by means of which the central parts of the truss frames of the bridge may be elevated and sustained in case of shrinkage or extraordinary compression of the timber.

This bridge was like, in many respects, the old Carrollton viaduct.

It was not till three years later that a patent was issued by the Office for bridge construction, when Augustus Canfield obtained protection for the first iron bridge ever granted by the United States. His papers are dated June 29, 1833. "The first upper strings," as the inventor calls them, or the chord-sections nearest the abutments, are firmly attached to the abutments and to the head of the first diagonal brace. To the head of the brace the head of the first post is attached, and also the "second upper string." To the foot of the first post is attached the first foot-piece, in which rests the foot of the second brace. The head of the second brace is sustained by the second upper string running from the head of the first brace and post. The first foot-pieces are prevented from moving horizontally by the second lower strings or chords, so that when the bridge is raised the upper strings are acted upon by a direct tension from the abutments, and the lower chords from a tension from the centre of the span. The floor timbers rest on beams supported by the lower cross-bars, and are of either wood or iron. The inventor says that spiral springs formed in the chords, as seen by the drawing, may be used if desired. He asserts that such a construction would leave every part at liberty to contract or expand without any strain, the chords yielding about an inch to two tons tension.



CANFIELD'S IRON BRIDGE.

(TO BE CONTINUED.)

THE HISTORY AND STATISTICS OF AMERICAN WATER-WORKS.

BY J. JAMES R. CROES, M. AM. SOC. C. E.; M. INST. C. E.

(*Continued from page* 369.)

CCCXC.—CAMDEN, N. J.

Camden, New Jersey, in lat. 39° 57' N., long. 75° 15' W., is on level ground, on the Delaware River, opposite Philadelphia.

It was incorporated as a city in 1831.

Water-works were built by a private company, about 1860, after plans of H. P. M. Birkinbine, C. E., taking the supply from the Delaware River. The water was led from the river in a wooden conduit to the engine house and then pumped by a Cornish engine through 2,880 ft. of 12-in. cast-iron pipe into a reservoir 180 by 344 ft. and 20 ft. deep. It is built in excavation and embankment, with inside slopes of 1 to 1, paved with brick. In the engine house is a plate-iron standpipe 5 ft. in diameter and 123 ft. high. There was also a Whiting auxiliary steam pump.

In July, 1870, the works were purchased by the city for $200,000. They were then in very dilapidated condition. The Whiting pump was removed and a Worthington high-pressure engine and pump put in its place. The reservoir, which contained 600 tons of sediment, was cleared and in the following year a 30-in. pump main was laid. A 30-in. distributing main was laid across Cooper's Creek. It was laid in a trench, dredged in the bottom, 200 ft. long and 22 ft. below high water, using a flexible joint designed by Jacob H. Yocum

In 1882 a Blake pumping engine of 5,000,000 gallons capacity was erected.

Distribution is by cast-iron pipe, of which 36.5 miles of from 30 to 3-in. diameter are in use, with 385 fire hydrants and 7,070 taps. Lead service pipes are used.

The population in 1880 was 41,658, and the daily consumption in 1881 was 2,111,000 gallons.

The expenses of the Water Department from January, 1871, to January, 1882, was $329,323.13.

The expenses for 1881 were $26,340.44, and the receipts $65,644.63.

The works are managed by a Water Committee of five members of the Council. William D. Middleton is the Superintendent.

CCCXCI.—DUNKIRK, N. Y.

Dunkirk, New York, in lat. 42° 30' N., long. 79° 30' W., is on level ground on Lake Erie.

Settled in 1815, it was incorporated as a city in 1880. Water-works were built for the village in 1871 by the Holly Manufacturing Company, taking the supply from the lake, and pumping it directly into the mains by 4 piston pumps of 9-in. bore and 24-in. stroke, driven by a steam engine. There are also 2 rotary pumps for fire pressure. The water is taken to the pumps through a cast-iron pipe laid to a crib in the harbor 700 ft. from the shore in 5½ ft. water. The ordinary pressure is 45 lbs. and the fire pressure 100 lbs.

Distribution is by 14 miles of cast-iron pipe of from 12 to 35 in. diameter, with 96 fire hydrants, 75 gates and 510 taps. Service pipes are of galvanized iron. Complaint is made that the mains are too small. The population in 1880 was 6,900, and the daily consumption in 1881, 900,000 gallons.

The works have cost $110,000. The bonded debt is $100,000 at 7 per cent.

The expenses of maintenance in 1881 were $7,300, and the receipts $5,600.

The works are managed by a Board of Commissioners. John Madigan is the Secretary, and J. C. Richardson the General Superintendent.

CCCXCII.—EVANSVILLE, IND.

Evansville, Indiana, in lat. 38° N. long. 87° 37 W., is on a bluff on the Ohio River. Settled in 1812, it was incorporated as a borough in 1814 and as a city in 1847.

Water-works were built for the city in 1870 by the Holly Manufacturing Co., taking the supply from the Ohio river and pumping directly into the mains. The suction pipe from the pumps is of 24 in. diameter and leads directly to the river, with a 16-in. branch which extends about 1,200 ft. up the river to three filter boxes 15 ft. in diameter and 6 ft. deep sunk in the river bed. These have never been finished and used. The main suction pipe sometimes becomes choked with sand and leaves.

The first pumps were 12 piston pumps of 14 in. bore and 14 in. stroke, worked by a Holly steam engine. In 1880 a Gaskill engine, driving 4 pumps of 18 in. bore and 36 in. stroke, was erected.

The ordinary pressure is 40 lbs. and the fire pressure 80 lbs.

Distribution is by 27 miles of cast-iron pipes, of from 20 to 4 in. diameter, with 227 fire hydrants, 109 gates and 1,287 taps. The city contributes $11,130 per year for public water. Service pipes are of galvanized iron.

The population in 1880 was 29,280, and the daily consumption in 1881 was 3,500,000 gallons.

The works have cost $500,000. The bonded debt is $300,000 at $7\frac{3}{10}$ per cent. interest.

The expenses in 1881 were $86,076.28, and the receipts $39,328.97.

The works are managed by a committee of three of the City Council. Charles Newman is the Secretary, and Baker W. Reynolds the Superintendent.

CCCXCIII.—LANCASTER, PA.

Lancaster, Pennsylvania, in lat. 40° 5 N., long. 76° 30 W., on the Conestoga Creek, is on undulating ground, rising to 100 ft. above the stream. Settled in 1718, and then called Hickory town, its name was changed to Lancaster in 1730. It was incorporated as a borough in 1742 and as a city in 1830.

Water-works were built by the city in 1836 after plans of Frederick Erdman, taking the supply from Conestoga Creek. A crib and stone dam 7 ft. high, created a storage reservoir and also furnished power to a water-wheel which drove two sets of upright plunger pumps of 30 in. stroke. There are three pumps in each set. There was also a horizontal Rush & Muhlenberg pump. A Worthington high-pressure steam pump of 500,000 gallons daily capacity was afterwards added. A Worthington duplex engine of 3,000,000 gallons capacity was added in 1878.

The water is lifted 200 ft. through 4,864 ft. of cast-iron pipe into two reservoirs built in excavation and embankment, of $2\frac{1}{2}$ and $3\frac{1}{4}$ million gallons capacity. There is also a standpipe of 5 ft. diameter, 40 ft. high, for high service supply.

Distribution is by 32 miles of cast-iron pipe, of from 20 to 4-in. diameter, with 300 fire-hydrants, 240 gates and 3,500 taps. There are 2 meters in use. The city pays for the hydrants. Lead and wrought-iron service pipes are used.

The population in 1880 was 25,846. The daily consumption in 1881 was 3,000,000 gallons. The original works cost $77,000. With additions they have cost $300,000. The water debt is not separated from other city indebtedness. The expenses in 1881 were $9,934, and the receipts $38,000. The works are managed by a committee of three members of each branch of the City Council, the Mayor, J. T. Macgonigle, being chairman.

CCCXCIV.—MACON, GA.

Macon, Ga., in lat. 32° 50' N., long. 83° 40 W. is on the Ocmulgee River. The business portion is on level ground between the river swamp and a range of hills on which the residences are mostly situated.

Settled in 1822, it was incorporated as a town in 1823 and as a city in 1832.

Water-works were built by a private company in 1881, after plans of A. E. Boardman, C. E., taking the supply from springs about 2 miles from the centre of the city. The water is conducted into a large well and pumped thence through 7,780 ft. of 12 in. pipe by a Worthington duplex steam pump, with steam cylinders of 12 and 20 in. and water cylinders of 10 in. bore and 15 in. stroke. It is lifted 150 feet into a reservoir 220 by 100 ft. and 26 ft. deep, built on a side hill in excavation and embankment, puddled and lined with concrete 6 inches thick. The surface is 127 ft. above the city. Distribution is by 9.6 miles of cast-iron pipe of from 12 to 4 in. diameter, with 53 fire hydrants, 59 gates and 216 taps. There are 104 meters in use. The city pays $60 per year for each fire hydrant. Service pipes are of galvanized iron.

The population in 1880 was 12,748, and the daily consumption is 175,000 gallons.

The capital stock of the Macon Gas-light and Water Company is $150,000. The water-works have cost $78,000. The bonded debt is $75,000 at 6 per cent. interest. The expenses for the year ending March 31, 1882, were $2,460, and the receipts $6,320.

J. M. Boardman is the President, and A. E. Boardman the Treasurer and Superintendent.

CCCXCV.—MANSFIELD, OHIO.

Mansfield, Ohio, in lat. 40° 45' N., long. 83° 35' W., is on elevated ground on the Rocky Fork of the Mohican River. It was settled in 1814.

Water works were built for the city in 1872, by the Holly Manufacturing Company, taking the supply from 2 springs, at one of which a reservoir holding 1,500,000 gallons is built. From this the water is pumped directly into the mains, piston pumps and rotary pumps for fire pressure, driven by a Holly steam engine. The ordinary pressure is 80 lbs., and fire pressure 100 to 125 lbs.

Distribution is by 17 miles of cast-iron pipe of from 16 to 4 in. diameter, with 115 fire hydrants, 85 gates and 657 taps. Wrought-iron service pipes are used. The population in 1880 was 9,992, and the daily consumption in 1881 was 600,000 gallons. The works have cost $192,000, and the receipts have been $40,721.47. The bonded debt is $95,000 at 6 and 8 per cent. interest.

The expenses in 1881 were $5,204.44, and the receipts $6,715.63.

The works are managed by three trustees elected popular vote.

H. R. Smith is Secretary and Treasurer, and E. McCoy the Superintendent.

CCCXCVI.—NILES.

Niles, Michigan, in lat. 41° 55 N., long. 86° 20 W., is on undulating ground on the St. Joseph River. Settled in 1828, it was incorporated as a village in 1838. Water-works were built for a private company in 1878 by S. L. Wiley, taking the supply from Berrian Lake, a small pond 5 miles from the town, fed by springs, and conveying the water in a 12 in. wrought-iron and cement pipe to a reservoir holding 300,000 gallons at 106 ft. above the city.

Distribution is by 8 miles of cement-lined wrought-iron pipe of from 12 to 4 in. diameter, with 50 fire hydrants and 300 taps. The town pays $50 per year for each hydrant. Service pipes are of wrought iron coated with tar.

The population in 1880 was 4,500. The daily consumption is 250,000 gallons.

No financial statistics are given.

S. L. Wiley is President, and C. T. Wiley, Superintendent.

CCCXCVII.—SACRAMENTO, CAL.

Sacramento, California, in lat. 38° 33' N., long. 121° 20' W., is on level ground at the junction of the Sacramento and American Rivers. In a great freshet in 1850 the whole city was flooded, after which the grade of the streets was raised 5 ft., making the city now about 8 ft. above water.

Settled in 1839, the first frame house was built in 1849. It was incorporated as a city in 1863.

Water-works were built in 1854 by the city, taking the water from the Sacramento River. No account of the early works is furnished. There are now in use a Holly pumping engine, of 3,000,000 gallons capacity, erected in 1873, and a larger engine, designed by A. J. Stephens, recently erected. There is near the pump house an elevated tank holding 250,000 gallons. Water is generally pumped directly into the mains with 40 lbs. pressure and 70 lbs. fire pressure.

Distribution is by 25 miles of pipe of from 24 to 3-in. diameter, principally of cast-iron. Several thousand feet of wrought-iron mains have been laid recently. There are 285 fire hydrants, 150 gates and 4,600 taps. Wrought-iron service pipes are used. The population in 1880 was 21,420. The daily consumption ranges from 1,000,000 gallons in winter to 3,000,000 gallons in summer.

The first works cost $140,000. The cost to the present time has been $350,000. There is no debt. The expenses in 1881 were $25,000, and the receipts $68,500.

The works are managed by a Board of Trustees. William Guttenberger is the Superintendent.

CCCXCVIII.—WEST SPRINGFIELD, MASS.

West Springfield, Massachusetts, in lat. 42° 6' N., long. 72° 31' W., is on the Connecticut River. It was detached from the town of Springfield and incorporated in 1774.

Water-works were built in 1874 for a private company by Goodhue & Birnie, taking the supply from Darby Brook, a stream flowing through a sandy water-shed of 400 acres area. It is impounded by a dam 250 ft. long and 17 ft. high, built entirely of puddled clay. It has never leaked. The reservoir thus formed covers 4 acres at 95 ft. above the village.

Distribution is by 8 miles of cement-lined, wrought-iron pipe of from 16 to 6 in. diameter, with 14 fire hydrants, 17 gates and 275 taps. The town pays for and maintains the hydrants and pays $1,000 per year for their use. Service pipes are of 1-in. gas pipe, lined with $\frac{1}{8}$ in. of clear cement.

The capital stock of the company is $50,000. There is no debt. No further financial statements are given.

Goodhue & Birnie own and manage the works.

(TO BE CONTINUED.)

The receipts of statistics, as follows, is acknowledged with thanks: From H. R. Smith, Secretary and Trustee, statistics and water rates of the water-works of Mansfield, Ohio. From Goodhue & Birnie, contractors, statistics of the water-works of West Springfield, Mass. From the Mayor of the city, J. T. Macgonigle, statistics of the water-works of Lancaster, Pa. From J. C. Richardson, General Superintendent, statistics and water rates of the water-works of Dunkirk, N. Y. From A. E. Boardman, Superintendent, statistics and water rates of the water-works of Macon, Georgia. From S. L. Wiley Construction Co., statistics of the water-works of Niles, Michigan. From L. F. Bassett, statistics and water rates of the water-works of Sacramento, Cal. From Baker W. Reynolds, Superintendent, statistics and water rates of the water-works of Evansville, Ind. From W. P. Osler, Assistant City Surveyor, statistics and reports of the water-works of Camden, N. J.

ENGINEERING NEWS
AND
AMERICAN CONTRACT JOURNAL.

Tribune Building, New York City.

GEO. H. FROST.....EDITOR AND PROPRIETOR.

S. D. V. BURR.....ASSOCIATE EDITOR.

SATURDAY, OCTOBER 25, 1882.

EDITORIAL ANNOUNCEMENTS.

Terms of Subscription.—To the United States and Canada, $4 per annum, including postage; all parts of Europe, $5, payable in advance. Remittances at the risk of the subscriber, unless made by registered letter or by draft, check or P. O. order, payable to GEO. H. FROST.

Terms of Advertising.—One inch, 12 lines, one insertion, $2; one month, $6.50; three months, $17; six months $30; one year, $50. Special rate for large space and long time will be given on application. Advertisements inserted for less than three months, payable in advance; for longer time, payable quarterly.

Articles for Publication in the current number should be received at the office of publication not later than Thursday morning, and advertisements not later than Friday noon.

Correspondence upon subjects which naturally belongs to the province of this journal is solicited.

CONTENTS.

	PAGE.
Truss Bridges (*Illustrated*)	371
The History and Statistics of American Water-Works	373
EDITORIAL DEPARTMENT:	
Notes	374
The Chicago Plumbers versus the Durham System of House Drainage	374
New England Water-Works Association	375
Specifications for Pumping Machinery	375
Personal	375
Recent Inventions Patented During the Present Week	375
CORRESPONDENCE:	
Conventional Colors	376
Spiral Curves	376
Technisher Verein	376
Reform Needed in Standard Gauge Rolling Stock	376
Book Notice	377
ENGINEERS' SOCIETIES:	
Liverpool Engineering Society	377
Engineers' Club of Philadelphia	377
Central Asian Railways	378
General Intelligence	378

NOTICES OF MEETINGS.

JOINT SESSION OF ENGINEERING SOCIETIES.

There will be a joint session of the American Institute of Mining Engineers with the American Society of Civil Engineers and the American Society of Mechanical Engineers at the Turf Club (formerly Union League) Theatre, corner of Madison avenue and Twenty-sixth street, New York, on Wednesday evening, Nov. 1, at 8 o'clock, for the purpose of hearing the memorial address on the life and works of the late Alexander Lyman Holley, to be delivered by R. W. Raymond, Ph. D.

THE attention of our readers is called to the advertisement on Page X. of "An Executive Manager."

TO KNOW what engineering devices have been patented is rapidly becoming a necessity in the practice of the modern civil engineer. It has become the fashion among technical journals to devote a considerable share of their space to the illustration and description of new patents; the two great engineering journals of England have, in the past two years given very particular attention to this class of news, and their example has been imitated in a small way by several of our American class publications. ENGINEERING NEWS has not the space nor the inclination to give to every little device that is patented. We have, however, endeavored to recognize the importance of this subject by obtaining for publication a carefully selected list of new inventions, or improvements, through a competent patent attorney, so that our readers may learn in time of what might assist, or embarrass them in their practice. The business of bridge-building has become so enormous in its volume, and competition in it is becoming so keen, that everything relating to it is of interest to civil engineers and contractors. The readers of ENGINEERING NEWS will, therefore, be interested in Mr. Brock's delvings amid the dusty records of the Patent Office, the results of which we publish under the title of "Bridge Trusses," showing what has been patented but is now free to any person who may wish to use the same. We consider this information too valuable to go out of print with the current issue of each week's installment, and so it has been arranged for publication in book form hereafter. Mr. Brock is making a specialty of engineering patents, and we doubt not his collation of these bridge specifications will commend him to the profession. Every bridge device, the patent of which has expired, will be described and illustrated, after which the patents in force may be considered.

WE have given before the names of the following cities of over 10,000 inhabitants from which no replies have been received to repeated requests for water-works statistics. There are about 150 smaller cities and towns in the same category. We call attention to this fact, and hope that some one of our readers will either send the desired information to Mr. Croes, or stir up the officers of the works in his town to send it.

Biddeford, Me.	Mobile, Ala.
Brockton, Mass.	Muskegon, Mich.
Burlington, Vt.	Portland, Or.
Canton, O.	Pottsville, Pa.
Chattanooga, Tenn.	Rock Island, Ill.
Cohoes, N. Y.	Rutland, Vt.
Columbus, S. C.	Saginaw, Mich.
Davenport, Ia.	San Jose, Cal.
Dover, N. H.	Shenandoah, Pa.
Easton, Pa.	Springfield, Ill.
Haverhill, Mass.	Stamford, Conn.
Hyde Park, Ill.	Stockton, Cal.
Joliet, Ill.	Steubenville, O.
La Crosse, Wis.	St. Joseph, Mo.
Lewiston, Me.	Wheeling W. Va.
Little Rock, Ark.	Youngstown, O.
Los Angeles, Cal.	

THE CHICAGO PLUMBERS VERSUS THE DURHAM SYSTEM OF HOUSE DRAINAGE.

The Chicago Plumbers' Union, after the manner of their compatriots in the House of Commons, are developing considerable ability as obstructionists.

The Durham system of drainage is the object of their hate in the present instance. From individual efforts to obstruct the Durham Company's pipes by deposits of pitch, sand and cement, they have risen to the dignity of open and united action against the further spread of a system which dispenses with plumbers.

One of their number having imprudently and impudently entered into a contract to execute the drainage work of a certain county court-house, according to the patented Durham system, at a price 25 per cent. below the open bid of the Durham House Drainage Co., of Chicago, and being prevented by the architect from ignoring the specifications and substituting the ordinary plumbing work for the Durham system, which he attempted to do, finds himself in the predicament of being under bonds to furnish a class of work beyond his reach. He then modestly requests the Durham Company to complete his contract *for the amount of his bid*, some $400 less than the company's bid, and at a loss to the company of about one hundred dollars. This proposition was declined, because Mr. Plumber had gone into the speculation with his eyes open, having been notified both personally and in writing, at the time of the letting of the contract, that he was trespassing to his own certain damage. Failing in this, he goes to his Union with his grievance and demands that they support him in making war on the Durham system, because the inalienable right of the plumbers to do bad work and do it often was in danger of suppression. The Union loyally responds and takes up the pot and ladle in defense of their lamenting brother. It was unanimously decreed that the Durham system is not *new*, "that it had been in use for years in jails, insane asylums and similar institutions; and that it was directly opposed to all the rules of sanitary science, and in direct violation of the laws of boards of health, city, state, and national." A vote of censure on the brother who had undertaken to perpetuate this vicious system would have been properly in order, but in the enthusiasm of the moment the matter was overlooked.

The campaign was vigorously opened; the building trades being in a depressed condition, time was abundant with the plumbers. They began the attack on the new Chicago City Hall—naturally. Two members of the Union are Aldermen—they are also experts and "SANITARY ENGINEERS." This fact cannot be discredited, because the *American Artisan*, a Chicago paper, makes the statement. But in fairness it must be mentioned, for the information of those not familiar with the status of sanitary science in Chicago, that it is the unwritten law there that the assumption of the trade or calling of plumber or sewer builder, or the engaging in the business of selling clay sewer pipe, entitles any person to the designation of "Sanitary Engineer." We are not prepared to make a positive statement to that effect, but we have the impression that the College of Plumbers confers the degree of S. E. Hence when one hears the appellation applied to a Chicago person, while it may not follow that he is the agent of some sewer pipe company, or carries on business from some dark basement as a drain-layer, yet it is not safe hastily to assume that he is the peer of Rawlinson or Shedd.

The two plumbers who were Aldermen were, of course, quite at home in matters pertaining to the City Hall, and the Durham system in that building was incontinently overhauled and investigated. We quote sundry extracts from the Chicago papers of recent dates:

"Ald. Ryan offered the following:

"Whereas, What is known as the Durham system of sewerage, soil and waste-pipes has been introduced into the new City Hall; and,

"Whereas, Such system and such work is faulty in construction and against all sanitary laws,

"*Resolved*, That the Committee on Public Buildings be and are hereby instructed to call to their aid a sanitary engineer or engineers to investigate into and report upon said system of drainage as applied to the new City Hall.

"Referred to the Committee on Buildings."

"One of the Aldermen, after the drainage is all in the City Hall, has suddenly discovered that the system is all wrong, and that there should be a radical change. How does it happen that he has just discovered that the kind of iron pipes being used is not as good as some other kind of iron pipe? He was one of the Aldermen who was around when the contract was given out. There had been a large amount of the same kind of pipe, put in at Pullman, and in many of the best houses in the city. It was no new thing, and hence how does it happen that the Alderman in question, with all these cases before him, has just discovered that the wrought-iron pipe is a failure? Either he has been negligent of his duty in not having attended to this matter before, or else he has some other kind of pipe which he wishes to take the place of that in use."

"THE DURHAM SYSTEM ALLEGED TO BE DEFECTIVE.—The Durham system of drainage introduced in the new City Hall of Chicago is criticised from a sanitary standpoint. Alderman Ryan, himself a sanitary engineer, proposes the appointment of Col. Waring, or some other competent engineer, or a board of sanitary engineers to investigate the Durham system and decide whether it is defective as a sanitary system before it is too late to mend matters. Alderman Ryan is of the opinion that it *is* defective. If the Council refuses to have an inspection of the sewerage of the new City Hall made, the Plumbers' Union proposes to have it done."

We also append a few communications from engineers, who possibly may be recognized as authority quite equal to that of Alderman Ryan, "Sanitary Engineer," and his brethren of the Plumbers' Union:

DEPARTMENT OF PUBLIC WORKS,
COMMISSIONER'S OFFICE, CHICAGO, Sept. 23, 1882.

Floyd B. Wilson, Esq., New York:

SIR: This note is addressed to you at the request of Mr. C. W. Durham, to say that I recommended his System of House Drainage for the new City Hall of this city because I regarded his plans as a great improvement over the ordinary mode of doing such work, and the material used to be superior to that entering into work of the kind ordinarily. * * *

Respectfully, DEWITT C. CREGIER.

Office of BURNHAM & ROOT, Architects,
115 DEARBORN STREET, CHICAGO, Sept., 23, 1882.

DEAR SIR: There seems to us no requirements of perfect sewering which the "Durham House Drainage" does not meet.

We have used the system for four years, at times putting in as many as six water-closets in a single dwelling, or thirty odd in an office building. We have tried it under varying conditions, from basement to garret, from extreme cold to high heat, in moist and dry atmospheres, and feel competent therefore to give an opinion. We indorse the system emphatically; never having had a word of complaint in any instance of the very large number of cases where it has been applied in our practice.

We have used it more than one hundred times.

Yours very truly, BURNHAM & ROOT.

F. B. WILSON, Esq., 140 Nassau St., N. Y.

171 LA SALLE ST., CHICAGO, Sept. 28, 1882.

Floyd B. Wilson, Esq., 140 *Nassau St., New York:*

DEAR SIR: During two years past the Durham System of House Drainage has been used in 1,200 or 1,300 houses at Pullman, where I have had charge of the sewerage work. I advised its use on the reason that I considered it the nearest perfect of any work used for such purpose, owing to the absolute certainty of securing tight joints if ordinary care is used, and for the further reasons that the material used and the method of supporting the closets are superior to that in ordinary use.

Great satisfaction has resulted from the use of the work at Pullman. Very truly,
BENEZETTE WILLIAMS, Civil Engineer.

DEPARTMENT OF PUBLIC WORKS.
Office of Consulting Engineer.
31 CHAMBERS ST., Room 10, NEW YORK, Oct 14, 1881.

Mr. C. W. Durham:

MY DEAR SIR: Having examined your System of House Drainage construction, and having known you for a long time, I feel satisfied that you not only have an excellent combination of design, material and workmanship, but that you will perform your contracts faithfully and skilfully.

Yours very truly, E. S. CHESBROUGH.

PHILADELPHIA, Sept. 24, 1882.

C. W. Durham, Esq., C. E.:

DEAR SIR: I see no reason why I could not recommend your System as an efficient and safe one, and, therefore, have no objection to your using my name as endorsing it to that extent. Yours truly,
RUDOLPH HERING.

NEW ENGLAND WATER-WORKS ASSOCIATION.

The above-named Association met at the Essex House, Salem, Mass., on Wednesday, Oct. 11. The meeting was called to order at 11 o'clock, President Lyon in the chair. Six applications for active and three for fine membership were received and considered, after which the candidates were duly elected members of the Association.

An informal discussion was had on the subject "of the best methods of detecting and preventing the waste of water."

Hiram Nevins of Cambridge, Edwin Darling of Pawtucket, and Frank Hall of Worcester, were appointed a committee to prepare a paper for discussion at the next meeting on the topic, "The causes and prevention of the waste of water."

C. W. Morse of Haverhill, A. S. Glover of Newton, H. G. Holden of Lowell, Edwin Darling of Pawtucket, and J. W. Lyon of Salem, were appointed a committee to prepare a paper for discussion at the next meeting on the topic, "Uniformity in compiling annual reports."

A. S. Glover of Newton, A. F. Noyes of Newton, and H. W. Rogers of Lawrence, were appointed a committee to prepare a report for discussion at the next meeting on the subject of "Water Meters."

Mr. Darling presented a copy of the record of duty made by the Corliss pumping engine at Pawtucket, R. I., for the seven months ending Aug. 31, 1882. This interesting record was carefully examined by many of those present and the copy presented to the meeting was ordered on file.

After the adjournment of the business meeting dinner was served, at the close of which the Hon. Samuel Calley, mayor of Salem, addressed the Association, extending a cordial welcome to the city of Salem. Addresses were also made by Albert A. Haggett, president of the Lowell Water Board, and President Lyon.

The members of the Association were then driven to the different interesting points of the Salem water-works.

At the pumping station at Wenham Lake, a vote of thanks was extended to President Lyon for his active endeavors and ample provision for the comfort and pleasure of the members upon this occasion.

LIST OF MEMBERS OF THE NEW ENGLAND WATER WORKS ASSOCIATION.

Active Members.

R. W. Bagnell, Superintendent, Plymouth, Mass. J. Stewart Brown, Registrar, Worcester, Mass. James M. Battler, Clerk, Lowell, Mass. Jonas M. Clark, Superintendent, Northampton, Mass. R. C. P. Coggeshall, Superintendent, New Bedford, Mass. J. Warren Cotton, Registrar, Cambridge, Mass. Edwin Darling, Superintendent, Pawtucket, R. I. William T. Dotten, Superintendent, Winchester, Mass. Albert S. Glover, Registrar, Newton, Mass. Robert M. Gow, Superintendent, Medford, Mass. S. E. Grannis, Superintendent, New Haven, Conn. Frank E. Hall, Commissioner, Worcester, Mass. Joseph C. Hancock, Superintendent, Springfield, Mass. James H. Hathaway, Registrar, New Bedford, Mass. W. W. Hawkes, Superintendent, Malden, Mass. William F. Hill, Superintendent, Dedham, Mass. Horace G. Holden, Superintendent, Lowell, Mass. H. N. Hyde, Jr., Superintendent, Newton, Mass. Moses Joy, Jr., Superintendent, Milford, Mass. Addison Lane, Superintendent, Melrose, Mass. Thomas C. Lovell, Superintendent, Fitchburg, Mass. James W. Lyon, Superintendent, Salem, Mass. A. H. Martine, Superintendent, Fall River, Mass. C. W. Morse, Superintendent, Haverhill, Mass. Hiram Nevons, Superintendent, Cambridge, Mass. Albert F. Noyes, City Engineer, Newton, Mass. W. H. Richards, Superintendent, New London, Conn. Henry W. Rogers, Superintendent, Lawrence, Mass. H. L. Schleiter, Superintendent, Meriden, Conn. Phineas Sprague, Registrar, Malden, Mass. Joseph G. Tenney, Superintendent, Leominster, Mass. Charles K. Walker, Superintendent, Manchester, N. H. William C. Wilcox, Registrar, Waltham, Mass. Horace B. Winship, Superintendent, Norwich, Conn.

Fine Members.

National Meter Co., New York. J. J. Newman & Co., Water-Works Contractors, Providence, R. I. W. B. Sherman, Hyd. Engineer, Corliss Steam Engine Co., Providence, R. I.

SPECIFICATIONS FOR PUMPING MACHINERY.

Nashville, Tenn., will receive proposals until 12 o'clock, noon, of Friday, November 10, 1882, for furnishing two first-class pumping engines.

Each engine is to have an easy capacity of 10,000,000 U. S. gallons in 24 hours, against a resistance equal to pumping from the Cumberland River, the source of supply, into the proposed storage reservoir, through a 36-inch force main, about 8,000 feet long. The extreme difference between high and low water in the river is about 55 feet, and the flow line in the reservoirs will be about 280 feet above low water in the river. The floor line of engine room will be 62 feet above low water level.

Each proposal must state the kind of engine offered, including a descriptive specification, sufficently in detail to describe the material, method and mechanicism of interior and exterior working parts; and must be accompanied by the necessary plan, elevation and sectional drawings.

The contract will include the furnishing of all transportation, tools, materials, labor and fixtures; and also the furnishing at the station of all iron work required in the construction of foundation masonry.

This contract will also include the necessary hot well or wells, feed-pumps, air-pumps, check and foot valves, steam and vacuum gauges and counters; also the lubricators, oil-pumps, cans, etc.; also furnishing, connecting and putting in place of all steam pipes inside the engine-room, together with the necessary pipes, valves, cocks, curves, etc.

The steam cylinders must be steam-jacketed, and all parts subject to loss of heat by radiation to be protected by placing next the metal a plastic composition compound of asbestos, or other acceptable material, over which will be placed at least one thickness of hair felting, and over all an ornamental wooden lagging.

Each engine to be supplied with the necessary air-chambers, on suction and delivery mains, also with foot-valves in suction pipes, and check-valves in delivery mains, at such points as may be directed by the engineer.

Steam pipes to be of wrought-iron, screwed together and thoroughly red-leaded. Connecting flanges to be lathe-faced, and made to correspond in size.

Each bid must stipulate the duty to be guaranteed, which shall not be less than 60,000,000 pounds of water raised one foot high per 100 pounds of coal consumed, without taking account of ashes or clinkers, or making any deductions of any kind. The duty will be determined, first, by a continuous run of 24 or 48 hours, at the option of the engineer, during which the full contract quantity of water will be pumped; second, by actual records taken for a period of 30 days, during which the engines will be operated at contract speed for half the time, or during each alternate 12 hours. Bidders will stipulate and guarantee the duty under each of these conditions. Steam will enter the cylinder at not over 70 pounds per square inch during the tests, and the duty will be computed on a basis of evaporation in the boilers of 8 pounds of water per pound of coal consumed—variable either way proportionate to the variation of actual evaporation from above rate. The pressure to be maintained during the tests will be 218 feet above floor line in engine rooms, plus the distance from floor to surface in pump well. No allowance will be made for friction in pumps or machinery.

The engines and appurtenances to be kept in good working condition for one year from the date of their completion.

The foregoing is but a brief synopsis of the main points in regard to the engines. The specifications are intended to describe a pumping service which shall be first-class in every particular.

Further particulars can be obtained from Thomas A. Kercheval, mayor of Nashville, or J. D. Cook, C. E., the consulting engineer, Toledo, O.

PERSONAL.

MR. RUFUS COOK is Chief Engineer of the Pemigewassett Valley Railroad. Headquarters at Plymouth, N. H.

A DISPATCH to the *World* from San Antonio, Texas, dated the 25 inst., says:

MAJOR R. W. PITRIKEN, Chief Engineer of the Mexican & Oriental Railway, was murdered by Indians in the mountains near Chihuahua, two days ago.

ROBERT A. SHAILER, late Assistant Superintendent Edge Moor Iron Co., has been appointed Engineer Department Bridges and other structures, C. M. & St. P. Ry.

MR. L. M. MUZZEY, of ADAMS & MUZZEY, Civil Engineers, Boston, is employed by the city of Keene, N. H., as Superintendent and Inspector of the Waring system of sewerage, now being introduced into that city.

HENRY ROBINSON SEARLE, a well-known architect during 25 years in Rochester, Washington, D. C., and New York City, member of the American Institute of Architects, of the Philosophical Society of Washington and the Union League Club, died in this city last Sunday morning, aged 46 years.

Of iron men named KRUPP there are two in Germany having A. for their sole initial. Both originally belonged to the same firm, and how they became separated forms an interesting story, which has just been told in Paris, where Herr ARTHUR KRUPP recently arrived. In 1855 the KRUPPS, by being thus together, took to casting guns at their factory, and in 1863 made the weapon which took the first prize at the French Exhibition of 1867. Soon after this the firm proposed to Marshal Niel and Gen. von Moltke to cast for both their governments respectively, an offer which was the cause of the retirement of ARTHUR KRUPP, who founded, thereupon, an iron foundry at Berndorf, in Austria, and left ALFRED to conduct the works at Essen. ARTHUR'S foundry, outside of Europe, if still there, is not heard of, but ALFRED'S gun business is the wonder of the world, as the statistics will show that it ought to be. The population of the Essen works is 15,700, and the number of boilers and engines is as follows: 429 boilers, 353 steam engines, with a horse-power of 18,500; 82 steam hammers, and 1,556 furnaces, of which fourteen are high furnaces, producing 300,000 tons of steel and 26,000 tons of iron yearly.

RECENT INVENTIONS PATENTED DURING THE PRESENT WEEK.

SAFETY GUARD FOR RAILWAY SWITCHES.

The invention consists of a reversable elastic cushion having its upper and under faces alike, and made with longitudinal central grooves extending from end to end. The sides fit snugly against the vertical faces of the adjacent rails and against the under faces of the heads of the rails and rest upon the feet of the rails.

MAGNETO-ELECTRIC RAILWAY SIGNAL.

The magneto-electric signal is arranged in a circuit between the switch-operating mechanism and

a magneto-generator, whereby when the circuit is closed (by the proper alignment of the switch) an approaching train in operating the generator gets a safety signal; but when the circuit is open (through the misplacement of the switch) no safety signal can be produced.

TELEPHONE CIRCUIT AND APPARATUS.

This novel arrangement of speaking and listening telephone circuit comprises a series of central-office switch-boards, and a circuit-changer located at a supervising desk. All the telephone circuits are looped through the supervising desk, to which is attached a supervising telephone. An auxiliary signaling-circuit is employed, which is provided with nominally open branches connecting respectively with magneto-generating machines and with a battery. A switch controls the signaling circuit, and a separate switch controls the supervising telephones and connecting devices, whereby either signaling or telephone circuit may be included in either of the switch-board telephone circuit loops. A circuit-changer is located at the chief operator's desk.

ECCENTRIC FOR STEAM ENGINES.

In this invention a balance or counter weight is secured to an adjustable eccentric in such position as to exert its gravity upon the eccentric in a reverse direction to the action of the steam pressure upon the stem of the valve, attached by the eccentric.

STEAM PUMPING ENGINE.

A new steam pump consists of two steam and two water cylinders, secured together upon the same axial line, and provided with a continuous plunger. They are combined with yokes and gear wheels for converting the reciprocating motion of the piston into rotary motion of the shaft. Eccentric and valve connections are operated by said shaft and communicate alternating motion to the valves of each of the steam cylinders.

OPERATING CABLE RAILWAY GRIPS.

This improvement relates to cable railways. Upon a frame are secured gripping-jaws connected to an operating lever, to which is secured a supplemental power hand-wheel, suitably journaled and provided with a pinion, which engages with a curved segment rack. A ratchet wheel and pawl, operated by a hand-lever also journaled and attached to the hand-wheel to retain the parts in position when set.

ELECTRIC SAFETY DEVICE FOR ELEVATORS.

In this invention, a frangible or separable electric conductor is combined with an elevator and traverses the portions of the hoisting machine or motor which are subjected to the working strain or wear, and arranged in a closed electric current including an electric magnetic detent which controls safety catches arranged to uphold the car, whereby the breaking of the parts of the motor so traversed will break the electric circuit and thereby relax the magnetic detent and release the safety catches to uphold the car.

WASHINGTON, D. C. F. B. BROCK.

CORRESPONDENCE.

CONVENTIONAL COLORS.

PITTSBURGH, Pa., Oct. 21, 1882.

EDITOR ENGINEERING NEWS:

I should like to hear from some of your readers as to what is the general practice regarding the use of *colors* for the various lines of a railroad survey map. I would like to know what are the proper (or usual) colors to use for the preliminary lines, location lines, changed or altered lines, contours, etc.?

I notice that on different railroads the practice differs and a full discussion of this subject might lead eventually to a system of uniformity, the advantages of which are obvious to all.

Respectfully,
L. E. VEL.

SPIRAL CURVES.

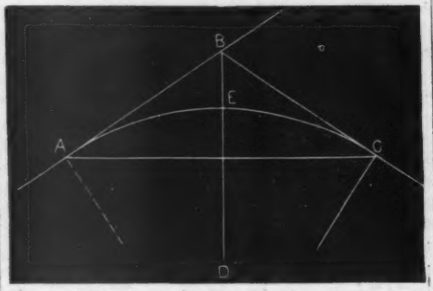
COLORADO SPRINGS, Colo., Oct. 24, 1882.

EDITOR ENGINEERING NEWS:

In your issue No. 10 (dated March 11) of this year, Mr. W. H. Fry, in the latter part of his article on spiral curves, says:

"Having laid out the end of the first spiral, which falls on station 21, by deflecting from the tangent 51½ minutes, as above, set up the transit at station 21. Take a backsight on station 20 with 51½ minutes on the other vernier, turn vernier to zero, when the line of collimation will be a tangent both to spiral and circular curve to be laid out."

Referring to the accompanying diagram, let *A B* be the tangent mentioned above as being deflected from, and *B C* the "tangent both to spiral and to circular curve." *A* is station 20 and *C* is station 21.



If I understand the above statement, it says in substance that the angles *B A C* and *B C A* are equal, each being 51½ minutes; and the curve *A E C* is a spiral, joining tangents *A B* and *B C*, and gradually increasing in curvature from *A* to *C*. The triangle *A B C* must then be isosceles, and *A B* equal to *B C*.

Can these tangents be so joined by a curve gradually increasing in curvature from *A* to *C*, or by *any* curve which is not symmetrical with respect to *B D* as an axis? *B D* being a line intersecting the angle *A B C*. S. E. REAUGH.

TECHNISHER VEREIN, Secretary's Office,
287 BROADWAY, NEW YORK, Oct. 16, 1882.

EDITOR ENGINEERING NEWS:

The members of the Technical Society of New York, at their annual meeting on Oct. 14, 1882, elected the following officers for the year 1882-3: President, Dr. H. Endemann; Vice-President, Hugo B. Roelker; Corresponding Secretary, Max C. Budell; Recording Secretary, Hermann Rassbach; Treasurer, Paul Goepel; Librarian, Geo. W. Wundram.

At the close of the year 1881-82 the Society's list of members shows 187 active members.

A complete annual report on the Society's working and progress during the past year is in preparation, and will be issued shortly.

Very respectfully,
MAX C. BUDELL, Secretary.

REFORM NEEDED IN STANDARD GAUGE ROLLING STOCK.

PONTIAC, Ill., Oct. 23, 1882.

EDITOR ENGINEERING NEWS:

The railroad interest in the United States is very large, being represented by 104,000 miles of railroads, costing about $35,000 per mile, equal to $3,640,000,000. Any improvements in any part of this vast property that would tend to lessen the cost of transportation, would be welcomed by the owners of the roads and the public. Railroad directors, railroad officers, engineering journals, master mechanic, master car-builder, civil and mechanical engineering societies have been discussing the evil of our railroads hauling so much dead weight for several years. So far, however, no effective remedy worthy of the name has been applied. Competition with the lakes, rivers, canals and narrow-gauge roads, will compel the standard-gauge roads to reduce the dead weight of their rolling stock by increasing the load carried per car. In 1881 the 104,000 miles of railroads in the United States earned $725,000,000, or nearly $7,000 per mile.

The average cost of running a standard gauge train one mile is about 95 cents. This would give 4,568 trains run over the mile in both directions per year, and about 30 per cent. of these would be passenger trains, or say 1,356 trains per year, giving two daily trains each way for 339 days in the year, costing $1,288.20, and leaving 3,212 trains, costing $3,051.80, to do the freight business of that mile. The estimate, in each case, will be made for one mile of road. If we assume that 60 ft. per mile is the average limiting grade of our roads, and that the average weight of standard-gauge engine and tender is 60 tons, with 30 tons on driving-wheels, the gross weight of train that such an engine could haul would be 350 tons, composed as follows: 18 cars weighing 180 tons, load 162 tons, tender 8 tons. Then the weight of train, including engine and tender, would be 410 tons. This would be the train load in the direction of the heavier traffic, and the number of tons hauled per year over the mile by 1,606 trains would be 260,172 tons.

In the opposite direction the average paying load would be one-third as much, or 54 tons, and the gross weight of train would be 18 cars, weighing 180 tons; caboose car, 8 tons; load, 54 tons; engine and tender, 60 tons; all, 302 tons; so that the number of tons hauled during the year in the direction of the lighter traffic by 1,606 trains would be 86,724 tons, making the entire number of tons of paying load hauled in both directions during the year 346,896, and the dead weight of train hauled during the year in both directions over the mile would be 603,856 tons; and if the engine and tender be included the dead weight would be 796,576 tons. This gives 2.35 tons of non-paying load hauled for every ton of paying freight. This gives an average car load of paying load in both directions of 6 tons; that is, a car that has a capacity of 10 tons gets only 0.9 of a load in one direction, and 0.3 of a load in the opposite direction. This seems a very small average car load, but the average car load of the Chicago & Alton Railroad for all the cars loaded, partly loaded and empty, in regular freight traffic, was only 6.46 tons in 1877, and the C. & A. R. R. has been one of the best managed roads in the country during the last 18 years. This gives the cost of hauling one ton of paying load over one mile equal to .88 of one cent, and the cost of hauling paying and non-paying load would be nearly .27 of one cent per ton per mile. So that the standard-gauge roads pay $937 per mile per year for hauling 346,896 tons of paying load, and $2,115 for hauling 796,576 tons of dead weight. This looks as if the standard-gauge roads need reforming their needlessly heavy rolling stock. The standard-gauge freight car can be made strong enough, at a cost of $70 per car, to carry two tons of paying load for every ton of car, or a car weighing 10 tons can safely carry 20 tons. When the standard-gauge rolling stock is improved, a standard-gauge freight train in the direction of the heavier traffic will consist of 12 cars weighing 120 tons; caboose car, 6 tons (the weight of caboose should be reduced to 5 or 6 tons); paying load, 224 tons; and engine and tender 60 tons, all making 410 tons. Then the number of trains needed to haul the 260,172 tons in the direction of the greater traffic will be 1,162, and the same number of trains will run in the opposite direction, hauling the 86,724 tons, making the whole number of freight trains needed to haul the 346,896 tons in both directions, 2,324, thereby saving the cost of running 888 freight trains over the mile, and reducing the number of freight cars one-third and the number of freight engines 27 per cent., and the cost of fuel, oil, waste, water and engine repairs, 27 per cent., and the wear and tear of track in the same proportion. The number of passenger trains can not be reduced by reducing the weight of passenger coaches, sleeping cars, baggage and express cars; but the weight of passenger engines can be reduced and this will effect nearly as great a saving as a reduction in the number of trains. The total cost of running a standard-gauge train one mile has been estimated at 95 cents; but, in fact, only about 60 per cent. of this is spent in the actual running of trains. The other 40 per cent., or 38 cents per train mile, being consumed in expenses that remain the same whether the business of the road is light or heavy, and does not change with the amount of business done or the number of trains run. The items of expense that change with the number of trains run are as follows: Maintenance of way, 18 cents; fuel, oil, waste, water and engine repairs, 19 cents; car repairs, 9 cents; engineer, fireman, conductor and brakemen, 11 cents, and other items that do not change with the number of trains run, 38 cents; all making 95 cents per train per mile. The standard gauge road would save $506.16, or say $500, per mile per year by reducing the number of freight

trains 888. This would reduce the operating expense per mile per year from $4,340 to $3,833.84, and increase the net earnings from $2,660 to $3,166.16, making the interest on $35,000 equal to 9 per cent. instead of 7½ per cent. $500 per mile per year is a large amount to waste in hauling needless rolling stock over the road. There is also a necessity for a reformation in locomotive construction. The weight on the driving wheels of locomotives is, in many cases, too much, and the rigid wheel base too long. Long, heavy trains are profitable, but there should be a limit somewhere. That limit is reached when the damage done by the engine to itself, and the cars that it hauls, and the track on which it runs, exceeds the profits derived from hauling long, heavy trains. The intelligent master mechanic knows how to build a good locomotive, but he does not always know whether it is more profitable to use an American engine with 44,000 lbs. on 4 drivers, or a mogul engine with 65,000 lbs. on 6 drivers, or a consolidation engine with 90,000 lbs. on 8 drivers with 15 or 18 ft. rigid wheel base. Nor does the master car-builder know whether it is more profitable to build a car to carry 10 or 20 tons. Master mechanics and master car-builders perform their duties, but they have not the authority and not always the qualifications to do what is for the best interest of their roads. That authority is vested in some official higher in authority. There is also another improvement that is much needed and neglected on many roads. Of roads built 20 or 30 years ago, many climbed over and wound around hills and bluffs that now reduce their efficiency. These obstructions should be reduced on roads doing considerable business, thereby increasing the carrying capacity 20 to 40 per cent. and the net earnings $500 to $1,000 per mile per year. Also the consolidation of several small struggling corporations under an efficient and intelligent general management would save two per cent. of the operating expense, and also insure the much needed improvements in rolling-stock and road. A large amount of capital thinks it sees a remedy for the evil of dead weight in the narrow-gauge railroad, and in consequence large amounts of money have been lately invested in building such roads, with what success remains to be determined.

In 1881, the 104,000 miles of railroads in the United States, costing $35,000 per mile, earned nearly $7,000 per mile, and spent in operation 62 per cent., or $4,340 per mile, leaving $2,660 net, or 7½ per cent. on the capital invested. A narrow-gauge railroad, with the same grades and relative curves, and with rolling-stock sufficient to do a business of $7,000 per year per mile, can be built for 85 per cent. of the cost of a standard-gauge road, or $29,750 per mile, saving $5,250 per mile, and this at 6 per cent. would give the narrow-gauge road an advantage of $315 per mile per year over the standard-gauge road.

Allowing that the expense of operation that does not change with the amount of business done or number of trains run is the same on the narrow-gauge road as on the standard-gauge road, then the cost of running a narrow-gauge train per mile would be as follows: Maintenance of way, 9 cents; fuel, oil, waste, water and engine repairs, 12¾ cents; car repairs, 6½ cents; engineer, fireman, conductor and brakeman, 11 cents, and other items of expense that do not change with the number of trains run, 28½ cents; all making 67¾ cents per train per mile. The cost of running trains differs largely on different roads and in the different parts of the country, but 95 cents is a fair average for the standard-gauge roads and 67¾ cents per train mile is a fair average cost of narrow-gauge as compared with the cost of a standard-gauge train mile. The average narrow-gauge engine has only half the hauling capacity of the standard-gauge engine, and allowing the weight of narrow-gauge freight cars to be about 4½ tons each, and that it can carry two tons of paying load for every ton weight of car, but gets only 9-10 of a load in the direction of the heavier traffic, then the narrow-gauge freight train will consist of 13 cars, weighing 61 tons; caboose car, 4 tons; and load, 110 tons, and engine and tender, 30 tons; all making 205 tons for the gross weight of train. Then the number of trains needed to haul the 260,172 tons of paying load in the direction of the heavier traffic will be 2,365, and the same number of trains running in the opposite direction will haul the 86,724 tons of freight in the direction of the lighter traffic. The number of narrow-gauge freight trains needed to haul the 346,896 tons on the narrow-gauge road would be 4,730; at 39¼ cents per train per mile would be $1,856.52. The 3,212 standard-gauge freight trains at 57 cents per mile cost $1,830.84. This gives the standard-gauge road a saving of $2,568 per mile per year in freight traffic more than the narrow-gauge road, but the narrow-gauge road saved $315 in construction and $369.51 in running 1,356 passenger trains, all making a total saving in favor of the narrow-gauge road, in construction and passenger traffic, of $684.51; from which deduct $2,568 saved by the standard-gauge road in freight traffic, leaving a balance of $658.83 in favor of the narrow-gauge road in construction and operation. This proves that the narrow-gauge roads are not to be despised as competitors for freight and passenger traffic. The standard-gauge roads with their freight cars improved can carry the 346,896 tons of freight in 2,336 trains, at 57 cents per train per mile, at a cost of $1,313.52, saving $543 per mile per year more than the narrow-gauge from freight traffic; from this sum must be deducted $315 saved by the narrow-gauge road in construction, and $369.51 saved in passenger traffic, all making $684.51, leaving a balance of $141.51 in favor of the narrow-gauge road from construction and operation over the improved standard-gauge road.

This is conclusive evidence that the standard-gauge roads must reduce the non-paying weight of their freight and passenger cars; otherwise, the narrow-gauge roads will increase in number and length. Capital will be invested where it can receive the largest returns. All these improvements add to the net earnings of the roads and lessen the cost of transportation to the patrons of the roads. The owners of railroad property, business men, producers and consumers are all interested in a reduction of the cost of transportation, and will encourage any means adopted to secure that end.

CIVIL ENGINEER.

BOOK NOTICE.

"Practical Farm Drainage and the Manufacture of Drain Tiles." By C. G. Elliott and J. J. Billingsly. Indianapolis, Ind. Price, $1.00.

We can recommend this little book as a most useful aid to those interested and engaged in farm drainage. It addresses non-professional men, and gives the principles that govern scientific drainage, in clear and plain language, illustrating them by numerous wood cuts in a manner that cannot fail to make the subject comprehensive even to the practical agriculturist. But the book will also be of use to engineers who are either to lay out works for the manufacture of tile pipe, or for draining a section of land, because it gives the most advanced principles and approved methods on both subjects.

Part I. treats on the mechanical and chemical effects of drainage in different soils with different contour both of surface and subsoil; it describes how to level for and lay out the drains, and discusses their depth, sizes and other details of the work with reference to different conditions. One idea advanced, concerning the location of submains and branches, we, however, cannot indorse. A calculation of cost will show that the usual system of parallel branches, discharging into a main from both sides, is *more* economical and just as effectual as the method preferred by the author, of running them parallel with the main and discharging into the latter by submains in the manner shown by the illustrations.

Part II. discusses the selection and preparation of clays for the manufacture of tiles; the best location for and arrangement of the factories, as well as giving numerous illustrations of kilns, mills and other machinery. Good practical advice is given on the selection of the entire outfit and also on the manipulations in pressing, handling and setting of tiles in the drying shed and kiln, and in burning them. The book closes with useful hints concerning the economy of the business.

ENGINEERS' SOCIETIES.

LIVERPOOL ENGINEERING SOCIETY.

At the meeting of this Society at the Royal Institution, Colquitt street, on Wednesday evening, 11th inst., Mr. F. B. Salmon, president, in the chair, a paper on "Some Recent Progress in Electrical Engineering" was read by Mr. I. S. Brodie, M. Inst. M. E. of the City Engineers Department. The paper described leading types of dynamo-electric generators, including those of Siemens, Gramme, Brush and Lachaussée, discussing the merits and comparative efficiency of each for the production of electric currents. The secondary batteries of Planté, Faure and DeMintins were next illustrated and described. Passing to the subject of the electrical transmission of power, the electrical railway of Siemens at the Paris exhibition was explained and illustrated by diagrams. An interesting discussion followed. We understand that a supplement to the paper on "Electric Lighting" will be read at the next meeting of the Society on the 25th inst., by Mr. Brodie.

ENGINEERS' CLUB OF PHILADELPHIA.

ROOMS NO. 1,523 CHESTNUT STREET,
PHILADELPHIA, Pa., Oct. 7, 1882.

The first meeting of the season was held this evening, President Rudolph Hering in the chair; 23 members and 5 visitors present.

Mr. W. H. Cory, of England, read a paper upon the subject of his process for the utilization of waste dust coal, which consists of mixing the coal with a small percentage of fine, dry fire-clay and another small percentage of silicate of soda, and submitting the block to a pressure of one ton to the square inch. The blocks are then stacked to dry, and in 24 hours (the chemical action of the alumina in the clay having converted the silicate of soda into silicate of alumina, or into an insoluble substance, in that time), the blocks are fit for use, and are as hard as ordinary coal. Among the advantages claimed for this fuel are the following: 7 per cent. more work than ordinary lump coal, there being no loss from dust falling through the fire-bars, etc.; that the fuel manufacturer can make his own silicate at little expense and trouble; that the fuel, being compressed, will stow in a much less space than coal; that it does not smoke, smell, decrepitate in the furnace or cause clinker; that the machinery is light and inexpensive; that the cost of manufacture will not exceed 50 cents per ton, and that all descriptions of coal can be utilized, without deteriorating their burning qualities. Mr. Cory exhibited samples made from anthracite, bituminous, and lignite coals, and concluded by giving statistics showing annual waste of coal in dust, etc.

The Secretary presented from Mr. H. M. Geer, a discussion of that part of Mr. P. H. Baermann's recent paper upon the "Thickness of Cast-Iron Pipe under Pressure" (Vol. III., 2, p. 109), wherein he refers to the rupture of a 12" pipe by the ram upon the sudden closing of a 2½" opening, under 230' head, by the breaking of a hydrant. For Mr. Baermann's formula, $\frac{W v^2}{2 g}$ (W = wt. of water in motion, v = velocity in feet per second, and g = acceleration of gravity) giving a pressure of 2,330 lbs. per sq. in., Mr. Geer substitutes $\frac{W v^2}{2 g} = P s$ (P = force or resistance, and s = space over which P acts) or $P = \frac{W v^2}{2 g s}$ and obtains, assuming that the moving mass of water is brought to rest with a uniformly retarded motion, in one second 1,354 lbs. per sq. in., in one half-second 2,708 lbs. per sq. in., and so on, inversely as the time. Without knowing the actual time of the closing of the valve and velocity of water, he considers deductions impossible. He refers to the reasoning of Mr. Fanning (Water Supply, p. 449) in this connection, as likewise erroneous. He attributes the cause of failure to thin, chilled, and imperfect pipe, and the general safety of pipes from effects of the ram to the existence of air-chambers at summits of undulations, the possible reflux of water to the reservoir, the compressibility of the yarn in the joints, and perhaps to the elasticity of the walls of the pipe, and the compressibility of the water itself.

The Secretary presented, for Mr. Howard Constable, a description of the Kinzua Viaduct, the highest bridge structure in the world, illustrated by numerous general and detail drawings and pho-

tographs. It forms part of a branch of the Erie Railway, into the coal-fields of Elk County, Pa., and its construction was found to be the most economical way of crossing the Kinzua gorge, a long-time obstacle in the way of railroad construction.

Surveys and investigations leading to the conception of this work were made by Mr. O. W. Barnes, Chief Engineer of the road before it passed into the hands of the Erie Railway. It was built according to Erie specifications, by Messrs. Clarke, Reeves & Co., under Mr. O. Chanute, Chief Engineer, assisted by Messrs. Chas. Pugsley, H. C. Keifer and the author. It contains 3,500,000 lbs. of iron, and cost $275,000. The paper describes the work very completely, and concludes with the following table of data:

DATA.

Total length of viaduct	2,052 ft.
Height of rail above stream	301 "
Number of towers	20
Height of iron work of lowest towers	16 ft.
" " highest "	278'3".
Length of girders over towers	38½ ft.
" " between "	61 ft.
Width of towers at top	10 ft.
" " bottom	10 ft. + ⅛ of height.
Live load "Consolidation" engines in any position. Equal on each tower of top	76,500 lbs.
Dead load on top of each column	22,650 "
" " each story, per column, about	5,000 "
Girders, calculated for a train of "Consolidation" engines.	
Chords strained in tension per sq. in. of net section	8,000 "
Chords strained in compression, per sq. in. of gross section	7,000 "
Diagonals strained per sq. in. from 5,000 to 7,000	
Rivets " " "	5,000

WIND PRESSURE.

Maximum compression. Structure loaded.	
Pressure assumed at the top of each bent	20,000 lbs.
Additional pressure at each story of tower	1,980 "
Maximum tension. Structure unloaded.	
Pressure assumed at top of each bent	15,000 lbs.
Additional pressure at each story of tower	3,300 "
Strains allowed on "Phœnix" columns, of the length used (10 to 33 ft.), with an ultimate strength per sq. in. of	35,000 lbs.
Maximum compression from live load per sq. in.	7,000 "
" " " wind pressure per sq. in.	10,000 lbs.
Greatest strain for combined loads per sq. in.	8,000 "
Maximum tension on diagonals (rods) "	15,000 "
" strains on struts "	24 to 3,000 "
" tension on anchor bolts "	12,000 "

HOWARD MURPHY,
Secretary and Treasurer.

CENTRAL ASIAN RAILWAYS.

If the Russians have shown themselves poor in carrying out schemes for the improvement of their means of communication in Central Asia, they have certainly not done so in bringing forward suggestions on the subject. No Central Asian railway yet exists, but another suggested route has been sketched out, and has received a certain amount of official patronage and support. M. von Schultz, an engineer of some repute, recently made a survey of the Orenburg steppe by order of Gen. Struve, perhaps the foremost of living Russian geographers, and his report has just been laid before the Russian Geographical Society. According to this authority, the best line for a railway would be by the Ilek Valley, which lies considerably westward of the ordinary caravan route beyond Orsk. After leaving the Ilek, some distance above the Fort Ak Tinbé, the projected line would cross the Mugodar range of hills, and, following a due south-easterly course, reach the Aral at Tetsebash Bay. From Tetsebash Bay, Kazalinsk, or Fort No. 1, can be easily reached—the whole distance from Orenburg being little more than 500 miles. But the principal advantage of this route consists in its being better watered and more thickly peopled than any other across the steppe. Considering that it is not only the most direct route beyond Orenburg, but that it is also watered for a great portion of the journey by the Ilek and Emba streams, it appears strange that this particular route has not been brought more prominently forward. However, as it has now received such excellent official approval, it may be expected at the least to receive as favorable consideration as any of the other schemes brought forward for improving the means of communication between Russia and Turkestan. There is one point in connection with this scheme that marks it out as distinct from all others, and this is that it would be a Central Asian railway pure and simple. Every other plan that has been brought forward has claimed for its principal merit that it would connect the Central Asian dependencies with the great Siberian system of the future.—*London Globe.*

GENERAL INTELLIGENCE.

☞ *We solicit and are always pleased to publish in these columns any items of interest that may be furnished us.*

GAS AND WATER.

ANALYSES of water from the vicinity of Hamilton, O., have been made for the purpose of selecting a site for water works.

PRICE OF GAS IN MISSISSIPPI.—The Meridan Gas Company charges $3 per thousand.

SELMA, Ala., has 60 artesian wells.

WATER FOR GALVESTON, TEX.—There are no water works at Galveston at present. A part of the water for the city is obtained from cisterns and the rest is brought in on the cars from Highland Lake, some 15 or 20 miles distant. Galveston is most certainly in need of a bountiful supply of water. Many schemes have been discussed, but, as yet, nothing has been done toward building any one.

THE new water main of Bayonne City, N. J., will be connected with the Jersey City system to-day.

ELECTRICITY.

DULUTH, MINN., has an electric light and power company.

THE TIME TELEGRAPH COMPANY, of this city, has filed articles of incorporation. Capital, $1,000,000.

THE Evansville, Ind., electric light works are in full working order.

STREETS, DRAINAGE, ETC.

THE compressed asphalt block pavement laid on Michigan avenue, Chicago, three years ago, is being removed, in order that the street may be paved uniformly throughout, as required by ordinance. An examination of the blocks as removed shows that it is practically as perfect as when laid.

RIVERS AND HARBORS.

LEVEE.—The work on the cross levee just north of Quincy, Ill., is nearly completed.

LEVEES IN LOUISIANA.—NEW ORLEANS, Oct. 26.—State Engineer Sidney F. Lewis has just returned from a prolonged tour in Carroll and Madison parishes, where he has been engaged in surveying and staking out levees to be built by the Mississippi River Commission. He has just completed the lines for a succession of levees from Bedford to Delta, a distance of five miles of important river front, and he is having his notes put in order so as to turn them over to the United States engineers. He reports that the United States contractors are in many places already at work, and have their camps established and their plant of apparatus and working machinery on the ground. There is good progress all along the lines of levee to be built. The same may be said of the State contracts, and, with a fair season and no unusually early floods, Louisiana stands a good show of having efficient protection from the inroads of the river. A large camp of penitentiary convicts, under the care of the contractors, is established at Bonnet Carre, and the work of rebuilding the broken banks there is about to commence. The levee to be built there will embrace 240,000 cubic yards of work for a distance of nearly a mile, at a height varying from 5 ft. to 25 ft., the latter in the deepest places.

RAILROADS.

WORK on the Buffalo extension of the Rochester & Pittsburgh road is progressing remarkably fast. Twenty-six miles are already graded and ready for the ties, while a force of 450 teams and 2,000 men are at work on the remainder of the line.

FIVE ENGINEERS are at work making a preliminary survey of the proposed extension of the Boston, Concord & Montreal Railroad to Colebrook.

THE TRACK of the Utah & Northern has reached Race Track Creek, 8 miles from Deer Lodge.

R. R. WORK IN FLORIDA.—The work on the Jacksonville & St. Augustine Railroad is being vigorously pushed to completion. All the grading has been finished, and there are on the several sections of the road about 200 hands at work. About 50,000 ties have been cut and distributed along the line of the road. The wharf opposite Jacksonville has been completed. The entire road will require about 1,600 tons of steel rails, all of which has been ordered. Two locomotives have been contracted for.

THE directors of the New York, New Haven & Hartford Railroad have prepared plans for a thorough reconstruction of the road.

THE last rail of the extension from Goshen to Benton Harbor, on Lake Michigan, was laid on the 24th.

The Kankakee & Southwestern Coal Branch Railroad has been completed. The road runs from Buckingham, Ill., to Essex, Ill., a distance of nine miles. Work is being pushed on the Bloomington extension of the Kankakee & Southwestern. One hundred teams and 200 men are now at work.

GEORGIA PACIFIC.—A recent report relative to the state and progress of work on the line from Atlanta to Columbus states that from Atlanta to Anniston, a distance of 105 miles, the track has been laid with steel rails over 60 miles, and is being laid westward toward Anniston on the remaining distance at the rate of over half a mile a day. Tracklaying eastward from Anniston began on Monday, Oct. 2, and the gap between the latter place and Atlanta will be closed and trains running in November. From Birmingham to Anniston the work has all been let to contract, the contractors are on the ground with heavy forces, and the work is to be completed by August, 1883. This section embraces the heaviest work on the road from Atlanta to Columbus. Between Atlanta and Anniston there is one tunnel a little over 500 ft. long, which has just about been completed, and between Anniston and Birmingham is one tunnel of 700 ft., upon which work has just commenced. From Birmingham westward to the western boundary line of Walker County the line has not been located, and surveys are still being made with reference to the best route and the tapping of the marvelously rich coal deposits in that region. It is almost certain the whole line from Atlanta to Birmingham and from Columbus eastward to the Walker County line will be completed by August 1, 1883. This will leave a gap of only about 60 miles, and manifestly it will be to the interest of the railway to fill this gap as speedily as possible; and it is the hope and purpose of the company to complete this 60 miles by January, 1884.

ARTICLES OF ASSOCIATION of the Chicago, Indiana & Ohio River Railroad Company have been filed with the Secretary of State of Indiana. The line will run from Hammond, Lake County, to Terre Haute.

THE "NICKEL PLATE" road has been sold to a syndicate. The price paid was 37 for the preferred and 17 for the common stock of the company. The company, which built the New York, Chicago & St. Louis Railway, was organized in April, 1881, but the road was only opened for traffic on last Monday with a full equipment in every respect. The length of the road, which runs from Buffalo to Chicago by way of Cleveland and Fort Wayne, is 521 miles. The name "Nickel Plate" was given it in the slang of Wall street because the initial letters, N. Y. C. and L., of New York, Chicago and St. Louis, pronounced rapidly make the sound of the word "nickel."

RESIGNATION OF A RAILROAD MANAGER.—CHEYENNE Wy., Oct. 26.—Robert Law, the well-known railroad manager, has resigned the superintendency of the Union Pacific Railway system in Wyoming, Utah, Idaho and Montana, to take the general superintendency of the roads in Iowa, Illinois and Missouri belonging to the Chicago, Burlington & Quincy Railway Company. Mr. Law is one of the best railroad managers in the West, and his loss will be seriously felt by the Union Pacific Company.

BRIDGES.

BRIDGE PLANS COMPLETED.—Plans and specifications for the bridge of the Highland Junction Company, across the Hudson River at Cornwall, have been finished.

THE RAILROAD BRIDGE at Yazoo City, Miss., must be completed, according to contract, by the first of January.

THE GREAT BRIDGE over the Missouri River at Bismarck, was tested last Saturday, and found perfect.

THE ROCK RIVER BRIDGE, at Moline, Ill., is progressing slowly. It is expected that the bridge will be fully completed by Nov. 1.

BUILDING.

PIPE-STONE CITY, MINN., will build a $10,000 schoolhouse.

DUBUQUE, Ia., is having a building boom. Seventy-nine buildings have been erected since last March.

LABOR.

THE bricklayers at Laredo, Tex., are on a strike for $5.50 per day.

CANALS

THE Hennepin Canal survey party has reached Annawan, and will come out at a point near Port Byron. They will finish the survey this week.

TUNNELS.

THE CHANNEL TUNNEL SCHEME.—LONDON, Oct. 13.—The committee under Gen. Sir Archibald Alison, appointed to report on the channel tunnel, consider that the exit of the tunnel should be commanded by a fortress of the first class; that the tunnel should also be provided with a portcullis, and with an arrangement for filling it for a sufficient space with an irrespirable gas, and that measures should be taken for the demolition of the land portion of the tunnel, for the temporary flooding of the main tunnel, and also for its total destruction by mines. These arrangements should be controlled by separate parties both inside and outside of the commanding fortress. When all this is done, the committee admit that it would be presumptuous to place absolute reliance upon even the most comprehensive arrangements. Memoranda from Gen. Sir Garnet Wolseley and the Duke of Cambridge, the Commander-in-Chief of the Army, are appended, even more strongly condemning the tunnel. The *Times* considers that this report has settled the question of the tunnel adversely for a long time to come.

LITERATURE.

"POTABLE WATER, and the Relative Efficiency of Different Methods of Detecting Impurities," by Chas. Watson Folkard, is No. 61 of Van Nostrand's Science Series, just reprinted from the paper read before the Institution of Civil Engineers, where it was considered worthy of considerable discussion.

THE *North American Review* for November presents an unusually diversified Table of Contents. "English Views of Free Trade," by the Hon. John Welsh, of Philadelphia, is a clear and forcible exposition of the difference between the economic situation of England and that of the United States, and of the considerations which make Free Trade imperative for the former country, if she would retain her present position as the world's workshop. Joseph Neilson, Chief Judge of the Brooklyn City Court, writes of "Disorder in Court-Rooms," a subject of profound interest to good citizens at all times, and more especially now in view of certain recent occurrences. The *obiter dicta* of the learned author touching the Guiteau trial and the Lawson-Gray incident at Dublin, are characterized by the best judicial temper. Dr. Wm. A. Hammond, ex-Surgeon-General of the U. S. Army, offers "A Problem for Sociologists," the problem being to determine the degree of responsibility before the criminal law, of persons affected by certain forms of insanity. "The Industrial Value of Woman," by Mrs. Julia Ward Howe, is a very able reply to an article recently published on "Woman's Work and Woman's Wages." "Advantages of the Jury System," by Dwight Foster, formerly a Justice of the Massachusetts Supreme Court, will command the attention of every thoughtful citizen, being a grave and learned defence of an institution which it is becoming the fashion to belittle and decry. The remaining articles are "Safety in Theatres," by Steele Mackaye, the distinguished actor and theatrical manager; "The Pretensions of Journalism," by Rev. Geo. T. Rider, and a symposium on "The Suppression of Vice," by Anthony Comstock, O. B. Frothingham and Rev. J. M. Buckley.

CONTRACTING.

THE contract for laying an asphalt sidewalk on Fifty-ninth street, from Eighth to Fifth avenue, and on Fifth avenue from Sixtieth to Seventy-fifth street, has been awarded to the New York Mastic Works, 35 Broadway, New York.